Communications Engineering Branch

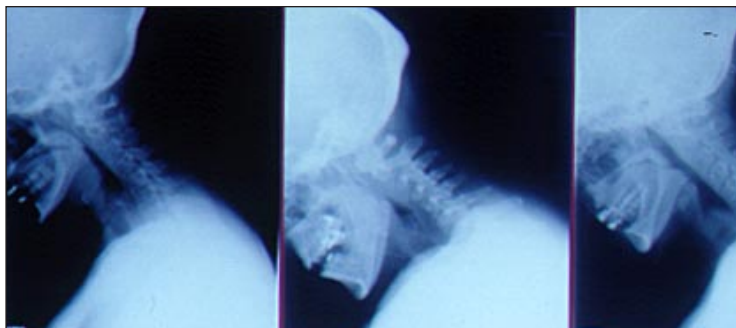**30 year Lister Hill Center accomplishments (CEB) in Imaging and Communications Technology following establishment of Center by Act of Congress in 1968:**

figure 1

1972
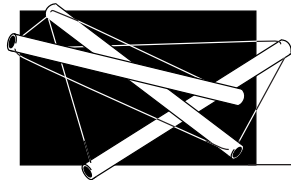ATS-1 Satellite-mediated biomedical communications experiments

1973
ATS-6 Satellite-mediated biomedical communications experiments

figure 2

1976-79
Biomedical Communications Experiments via the joint US Canadian Communications Technology Satellite (CTS). Broadband two-way video communications among locations in 4-state northwest U.S. area and NIH. Established broadcast studio *(fig. 1)* and classroom *(fig. 2)* facilities for distance learning and telemedicine.

Engineering accomplishments: developed and installed earth stations *(fig. 3)* to open up Ku band for satellite communications for the first time, this band later routinely adopted in commercial services.

figure 3

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1980

Designed and installed in the NLM cafeteria a World Map and clock displaying time in cities in every international time zone. One of the few developments in the country still functioning after 18 years!

1982-83

Designed, established and evaluated a Videodisc Premastering Facility *(fig. 4, 5, 6)*. Created first NLM interactive videodisc.
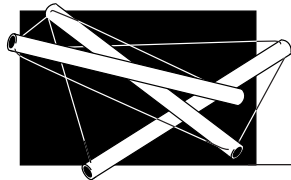

figure 4

figure 5

figure 6

1983

Video Bulletin Board. An Apple II-based system for the video display of text (announcements, news bulletins, etc.) sent over the building cable system to public places at NLM. This was the prototype for later use of commercial system now conventionally used throughout NLM.
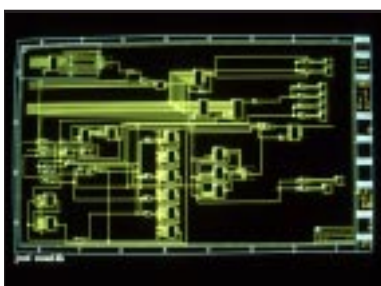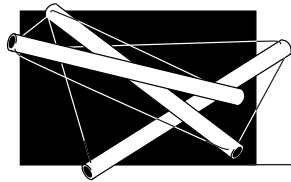
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figure 7

1980-84

Electronic Document Storage and Retrieval (EDSR): One of the first prototypes in the world for scanning, storing on optical disks, retrieving and displaying documents *(fig. 7)*. This system was used to investigate applicability of this technology to document preservation. CEB used first of-its-kind commercial equipment, e.g., the loose leaf scanner *(fig. 8)*, but also designed and built hardware interface boards for most EDSR subsystems *(fig. 9, 10)*.

figure 8

figure 9

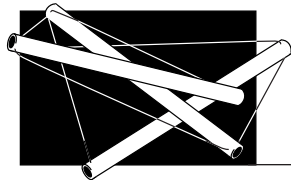figure 10

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figure 11

figure 12

1981

Document Capture Workstation or "Bookscanner": Developed first "face-up" bound document scanner using movable linear CCD array. An early version enclosed in a tent-like housing *(fig. 11)* was followed by a more streamlined desktop system *(fig. 12)*.
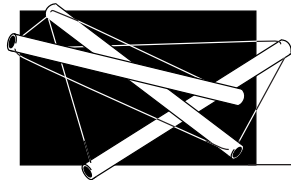
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figure 13

1991-94

System for Automated Interlibrary Loan (SAIL): SAIL automatically retrieved interlibrary loan requests, parsed them, linked them to document images and automatically transmitted them by fax or printed them locally for postal mail. Document images were stored in a stack of 12" optical disk drives *(fig. 13)*. By 1992, the SAIL system contained journal articles from high-use 64 biomedical titles, and was delivering 5% of the NLM's interlibrary loan requests with no operator intervention.

1992-96

17,000 cervical and lumbar spine xrays from the NHANES II nationwide survey *(fig. 14, 15)* were scanned and stored in an optical jukebox *(fig. 16)*. Built specialized high-resolution workstations for radiologist review and reading of digital xrays *(fig. 17)*, quality control for the xrays, and access to the xrays and associated text data via Internet *(fig. 18)*.

figure 14

figure 15

figure 16

figure 18

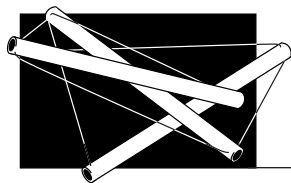## Communications Engineering Branch

figure 17

1993

JPEG Evaluation Tool: The JET system enabled researchers to study the image quality effects of different quantization tables on xray images compressed by the JPEG technique.

1995

Large image transfer experiments between NLM and University of California at San Francisco done using Asynchronous Transfer Mode (ATM) protocol via NASA's Advanced Communications Technology Satellite (ACTS). This early use of ATM was to begin investigating this protocol anticipated to become a key component of the Next Generation Internet.

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1996

Access to mixed xray image/text databases at NLM, and realtime digital video transmissions, both using ATM protocol. Demonstrations at RSNA meeting site in Chicago, University of Texas, and conferences in Washington DC.

1996

Visible Embryo Project: developed a Web-based distribution system for the digitized embryo images and associated text from the historic Carnegie Embryo Collection. Software later transferred to Armed Forces Institute of Pathology for routine use.

1996

DocView, a Windows client system for document retrieval and management over the Internet: developed and beta tested internationally.

1996

Workstation for Interlibrary Loan (WILL), an integrated workstation for automated delivery of documents (scanned on request) over the Internet, by fax, and by mail. Designed and developed in CEB, and installed in the NIH Library *(fig. 19, 20)*.
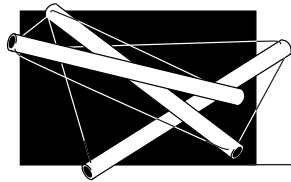
1996

Medical Articles Records System (MARS): Developed and installed for routine operation a system for partially automating the entry of citation data from medical journals to MEDLINE.

figure 19

figure 20

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1997

First U.S. patent at NLM issued to Dr. Daniel Le, CEB, for the invention of a system to automatically discriminate between landscape and portrait mode scanned documents.

1997

First CRADA signed by NLM: for the commercial exploitation of the WILL system developed in the CEB lab and beta tested at NIH Library.

1998

Released DocView version 1.0 after extensive beta testing. Users in 28 countries begin using the software for document retrieval and viewing.

1998

MARS system achieves target production level of 600 completed records a day.